

Low Impact Development LID

- * Effective Site Design
- * Natural Stormwater Management Practices

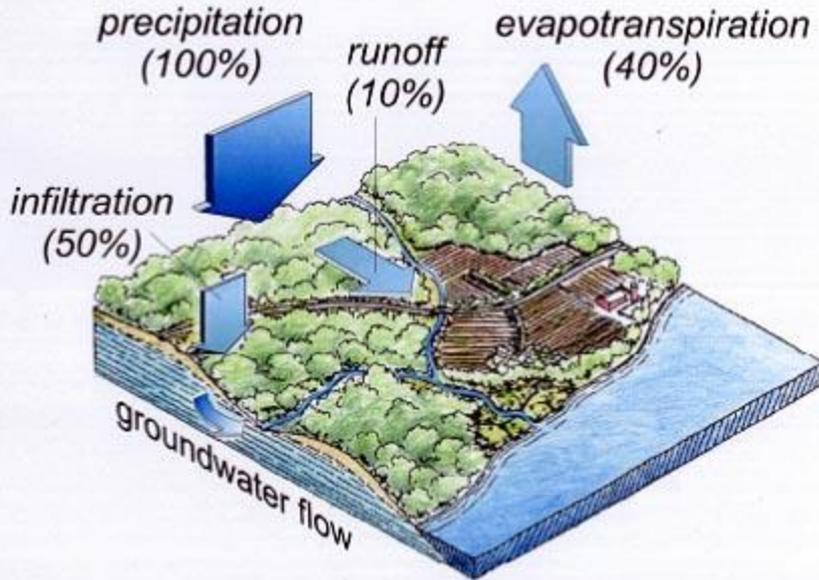


Smart Growth / Smart Energy Toolkit



The Problem

Conventional Development

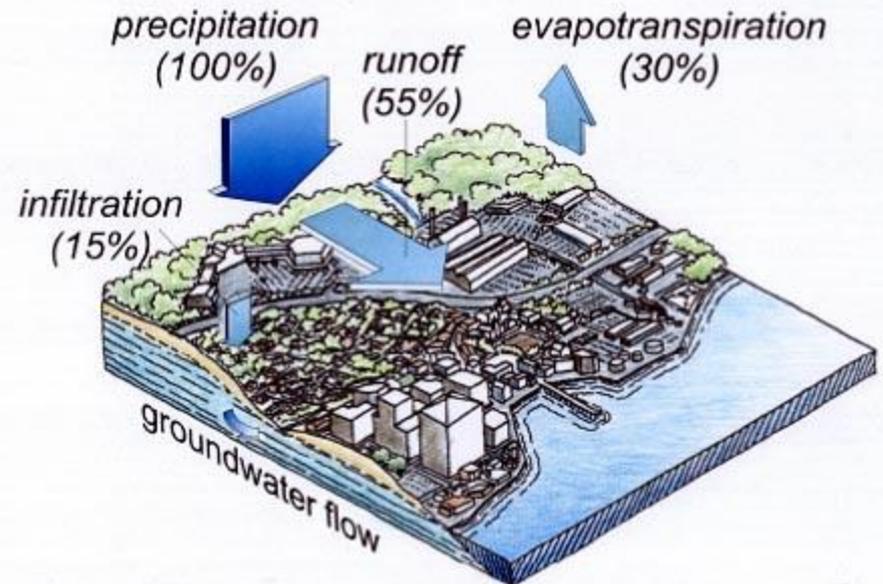


- Loss of natural land or open space
- Depleted drinking water supply
- Reduced quantity and quality of water resources
- Increased infrastructure costs & maintenance

Smart Growth / Smart Energy Toolkit

The Solution

Smart Development



- Less land clearing and grading costs
- Reduced infrastructure costs
- Protection of regional water quality
- Reduced stormwater runoff

Low Impact Development

“Conventional” Planning & Design



- Style of suburban development over the past 50 years
- Generally involves larger lots
- Clearing and grading of significant portions of a site
- Wider streets and larger cul-de-sacs
- Enclosed drainage systems for stormwater conveyance
- Large detention ponds

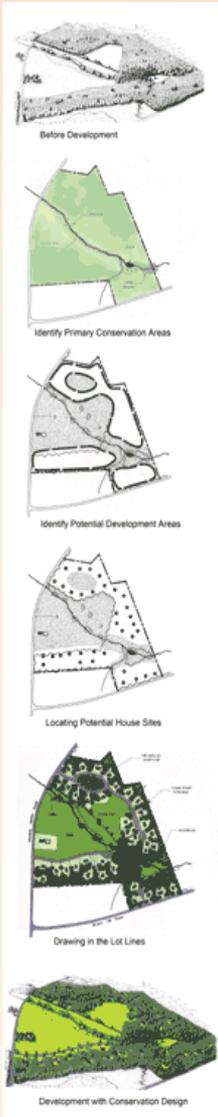
Site Design Planning Process



- #1 AVOID IMPACTS** – Preserve Natural Features and Use Conservation Design Techniques
- #2 REDUCE IMPACTS** – Reduce Impervious Cover
- #3 MANAGE IMPACTS** – Utilize Natural Features and Natural Low-Impact Techniques to Manage Stormwater

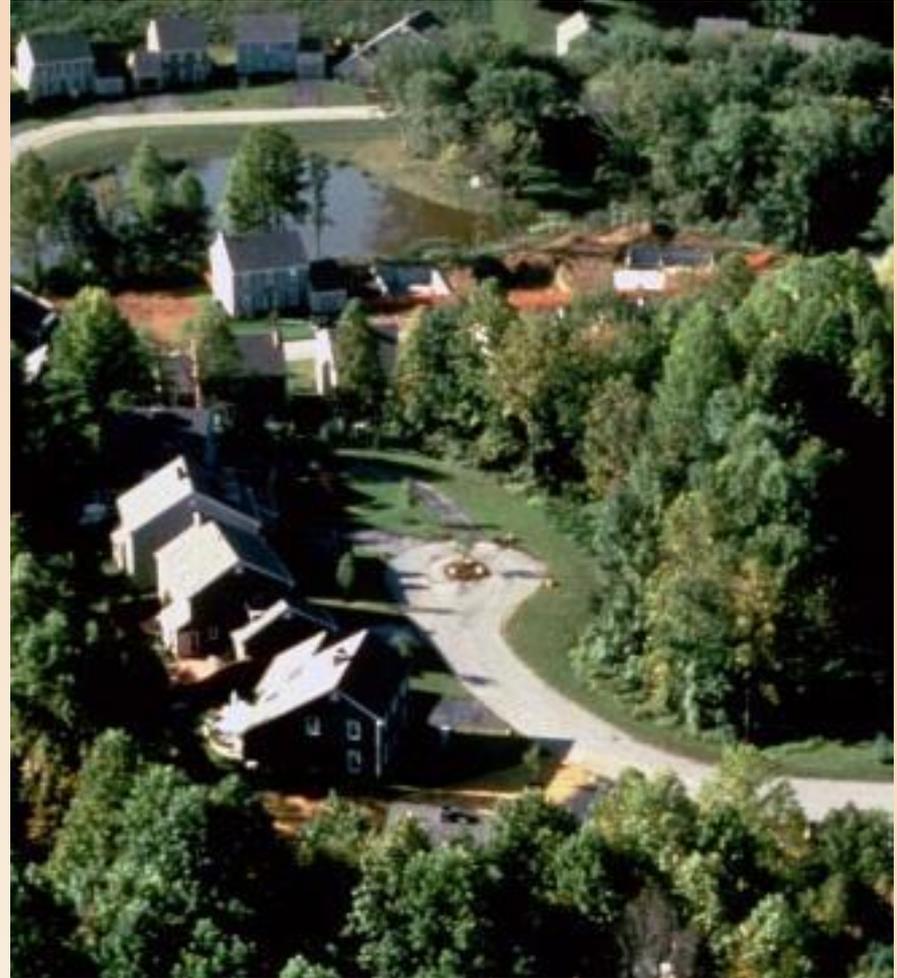
LID Site Design

- Conservation of natural hydrology, trees, and vegetation
- Minimized impervious surfaces
- Dispersal of stormwater runoff
- Conservation of stream & wetland buffers
- Ecological landscaping



Site Design Practices

- Reduce storm pipes, curbs and gutters
- Preserve sensitive soils
- Cluster buildings and reduce building footprints
- Reduce road widths
- Minimize grading
- Limit lot disturbance
- Reduce impervious surfaces

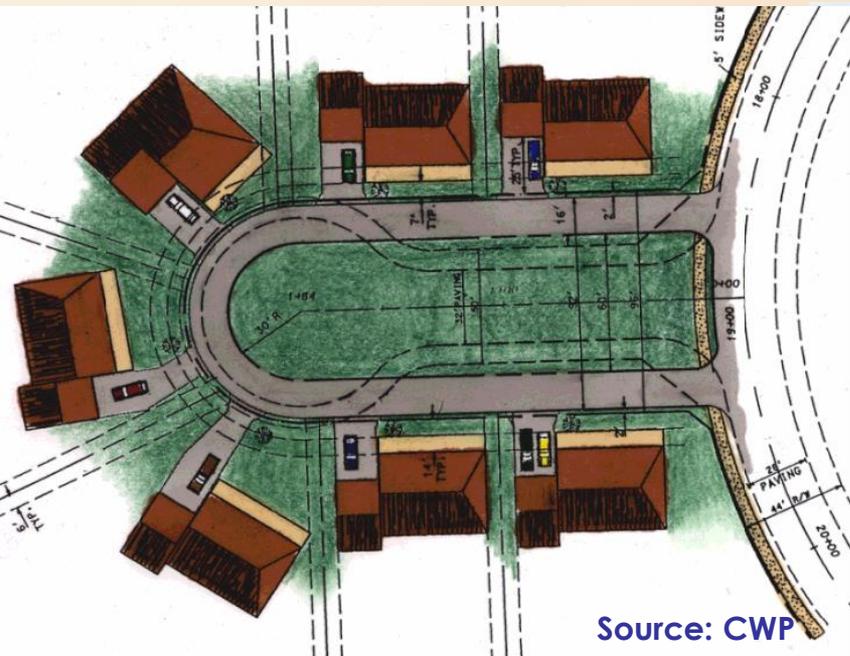


Better Site Design on Roadways and Driveways

- Narrower streets
- Alternative cul-de-sacs
- Shared driveways



Source: City of Portland, OR



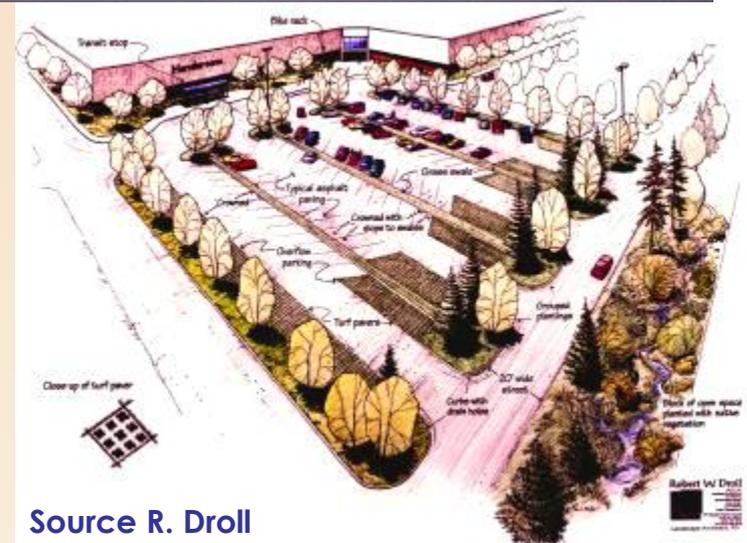
Source: CWP



Source: R. Claytor

Better Parking Lot Design

- Incorporate green strips and buffers
- Create multiple small lots
- Reduce requirements near transit
- Allow shared parking
- Require compact spaces
- Set parking maximums
- Alternative permeable pavers in overflow areas



Source R. Droll

LID Stormwater Techniques

- Rain Barrels and Cisterns / Water Re-use
- Stormwater Planters, Tree Planting
- Permeable Paving
- Open Channels
- Bioretention
- Stormwater Wetlands
- Green Rooftop Systems
- Vegetative Buffers
- Infiltration



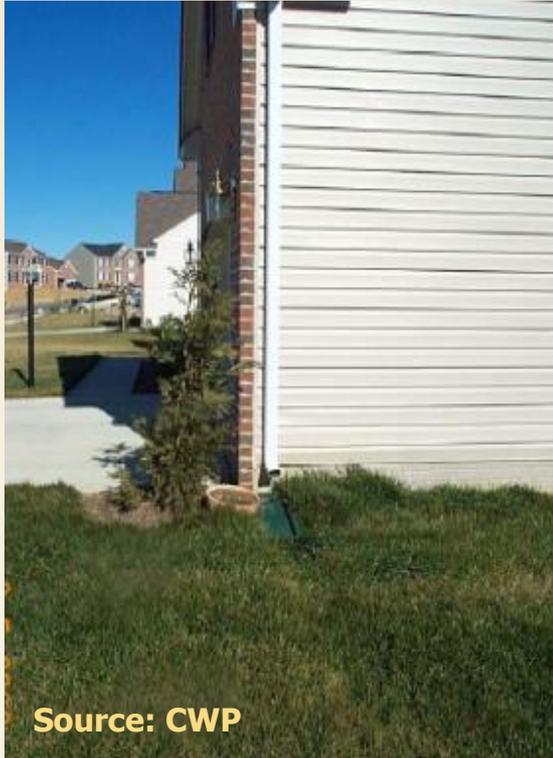
Rain Barrels and Cisterns

Runoff Reduction & Water Conservation

- Downspouts directed to tanks or barrels
- 50 -10,000 gallons
- Excess diverted to drywell or rain garden
- Landscaping, car washing, other non-potable uses



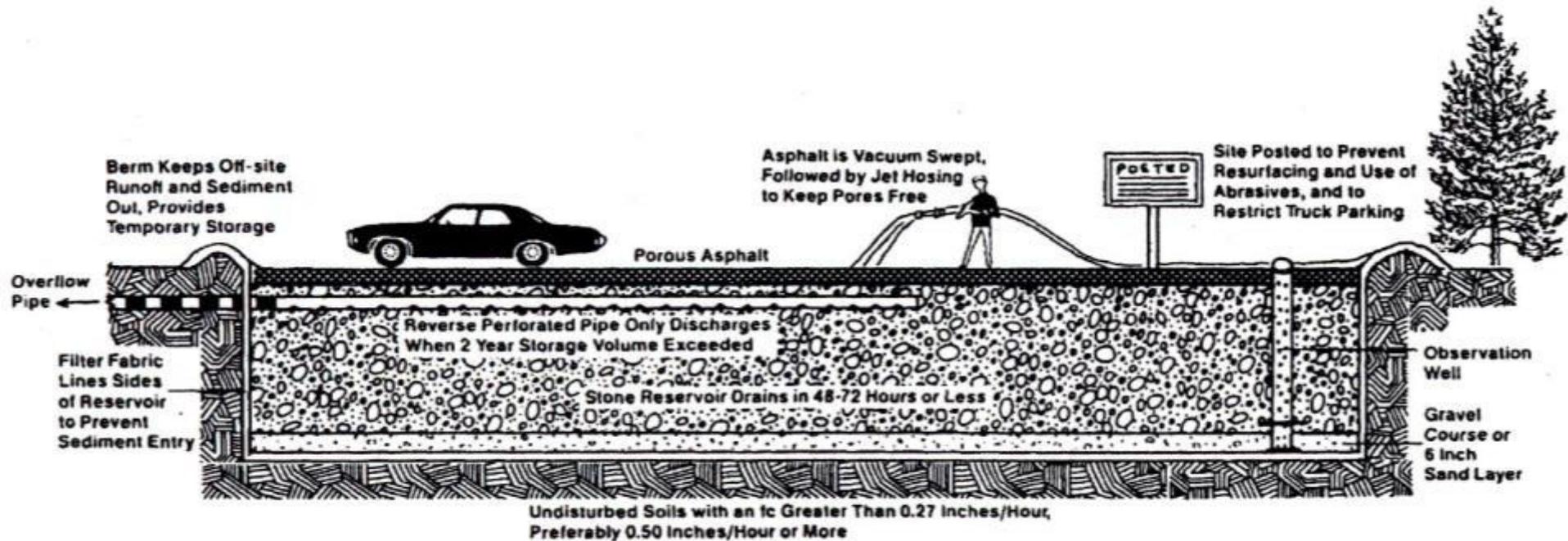
Dry Well Infiltration of Roof Runoff



Disconnection of Rooftop
Runoff to Vegetated Swale



Permeable Pavement



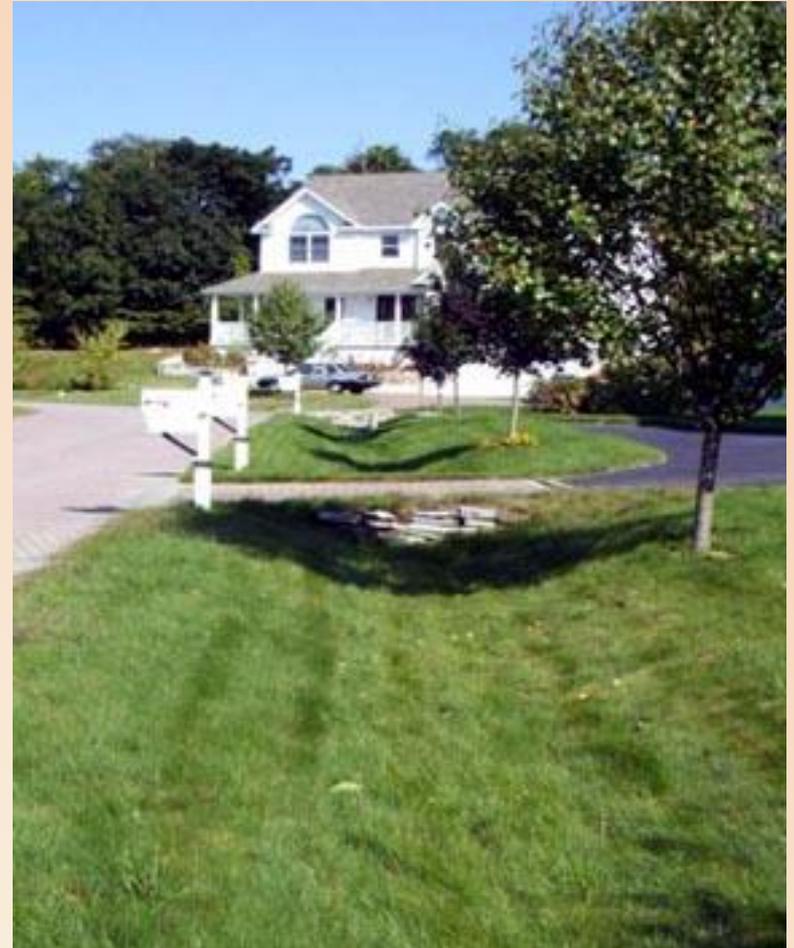
Permeable Pavement @ Work



Vegetated Swales

Conveyance, Treatment, Infiltration

- Roadside swales (“country drainage”) for lower density and small-scale projects
- For small parking lots
- Mild side slopes and flat longitudinal slopes
- Provides area for snow storage & snowmelt treatment



Bioretention Applications

- Parking lot islands
- Median strips
- Residential lots
- Office parks



Bioretention Applications

- Urban retrofits
- High-density areas



Vegetated Filter Strips

Pretreatment and Attenuation

- Mild vegetated slopes
- Adjacent to small parking lots and roadways
- Another opportunity for snow storage



Source: City of Portland, OR



Source: City of Portland, OR

Green Roofs



- Stormwater Runoff absorption/collection
- Reduced flooding of and damage to urban streets
- Interior heating and cooling benefits of 10 degrees or more
- Air purification
- Recreational amenity
- Improved aesthetics
- Extended roof life, estimated at 40 years



World Trade Center, Boston
Photo: ©2005 Roofscapes, Inc.

Stormwater Planters



- Vegetative uptake of stormwater pollutants
- Pretreatment for suspended solids before they reach water-treatment facilities
- Aesthetically pleasing
- Reduction of peak discharge rate

LID BENEFITS

Environmental and Community

- Protects unique or fragile habitats
- Reduces the pollution impacts of stormwater runoff
- Promotes aquifer recharge
- Provides opportunities to link wildlife habitats
- Conservation values are part of the planning process
- Can further goals of open space and community development plans

The planning process inherently protects natural resources and promotes recharge to underlying aquifers.

Local Authorities

Better Site Design will—

- Identify and preserve natural features
- Maintain natural hydrology
- Help respect a butter's properties
- Retain property values
- Augment groundwater supplies
- Maintain high water quality
- Provide new green space as a amenity

Local Authorities

- Green strips in parking lots provide shade, serve stormwater collection and treatment needs, and reduce the need for large unsightly detention basins
- Reduction in overall parking area reduces runoff volumes
- Shared parking allows for more retail tax revenue
- Enhanced aesthetics can increase retail traffic and sales revenue

Local Authorities

- Infiltration replenishes groundwater supplies, increases aquifer recharge, and maintains base flows to streams and wetlands
- Less runoff and sediment going into public drainage systems = lower maintenance costs, more overall capacity, and a longer lifespan for drainage systems
- Reduced frequency and severity of Combined Sewer Overflow (CSO) events improves water quality and public health

LID BENEFITS

For Developer and Realtor

- Streamlines the plan review process, reduces time and costs
- Adds valuable amenities that can enhance marketing and sale prices
- Decreases site development costs by designing with the terrain

The permitting structure encourages smart growth and facilitates a process that is clear, easy to understand, and cost-effective to developers.

Developer and Realtor

- Low Impact Development practices can cost less than conventional drainage techniques
- LID can reduce the size and number of detention facilities and the size and cost of drainage infrastructure
- Systems designed to mimic nature can enhance aesthetics and property home values
- Surface vegetative systems are more visible, thereby facilitating routine maintenance and requiring less maintenance than underground practices

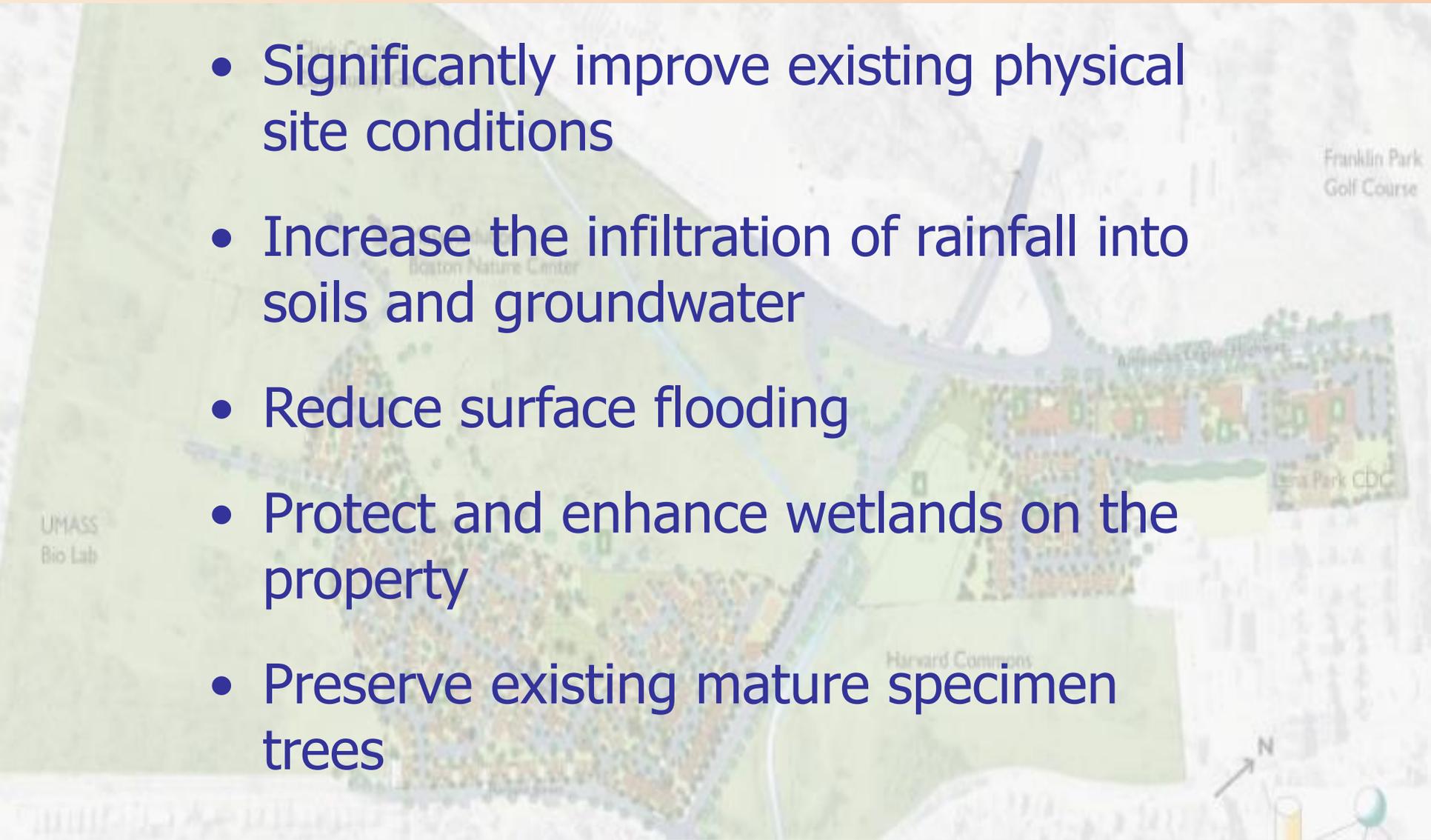
Genzyme Corp. Headquarters Cambridge

- Green roof
- Recycled roof runoff for “make up” water for cooling system
- Moisture sensors in green areas to minimize irrigation needs



Olmsted Green, Boston

- Significantly improve existing physical site conditions
- Increase the infiltration of rainfall into soils and groundwater
- Reduce surface flooding
- Protect and enhance wetlands on the property
- Preserve existing mature specimen trees



Olmsted Green, Boston

LID methods will include—

- Tree preservation
- Soil amendments to improve vegetative growth and erosion control
- Vegetated swales and rain gardens
- Subsurface infiltration
- Permeable pavers and pavements
- Stormwater System Operations & Management Plan

Pinehills, Plymouth

- * Small clusters
- * Natural features retained
- * Minimum impervious surfaces
- * Narrow roads



- * Shared driveways
- * Houses sited with natural terrain
- * Vegetation retained



- * Narrow roads
- * "Country drainage"

LID Model Bylaw

- Provides incentive for conservation site planning
- “Stormwater Credits” reduce the size and number of conventional practices
- Requirement to treat stormwater
- Expands upon Massachusetts Stormwater Policy by including all land areas (beyond Wetland Protection Act jurisdiction)

Links for More Information

- The Low Impact Development Center
www.lowimpactdevelopment.org
- ECONorthwest applies economic analysis to better understand the benefits of low-impact developments including a presentation by Ed MacMullan
www.econw.com/casestudies/casestudy?study=low-impact-development
- Rooftops to Rivers: Green Strategies for Controlling Stormwater and Combined Sewers Overflows
www.nrdc.org/water/pollution/rooftops/contents.asp
- Low Impact Development, Buzzard's Bay National Estuary Program
www.buzzardsbay.org/lid.htm
- The University of New Hampshire Stormwater Center
www.unh.edu/erg/cstev/
- Greenscapes
www.nsrwa.org/greenscapes/default.asp

Links for More Information

- Low Impact Development Center: Urban Design Tools
www.lid-stormwater.net/
- Massachusetts Low Impact Development Toolkit, developed by the Metropolitan Area Planning Council (MAPC)
www.mapc.org/LID.html
- Green Roofs for Healthy Cities
www.greenroofs.net/index.php
- Heat Island Effect – Trees and Vegetation
www.epa.gov/hiri/strategies/vegetation.html
- Building Better II: A Guide to America's Best New Development Projects
www.sierraclub.org/healthycommunities/buildingbetter/